LONDON-WEST MIDLANDS ENVIRONMENTAL STATEMENT

Volume 5 | Technical Appendices

CFA3 | Primrose Hill to Kilburn (Camden)

Water resources assessment (WR-002-003)

Water resources

November 2013

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Department for Transport

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1 Introduction

1.1 Structure of the water resources and flood risk assessment appendices

1.1.1 The water resources and flood risk assessment appendices comprise three parts. The first of these is a route-wide appendix (Volume 5: Appendix WR-001-000).

1.1.2 Specific appendices for each community forum area (CFA) are also provided. For the Primrose Hill to Kilburn (Camden) area (CFA3) these are:

- a water resources assessment (i.e. this appendix); and
- a flood risk assessment (Volume 5: Appendix WR-003-003).

1.1.3 Maps referred to throughout the water resources and flood risk assessment appendices are contained in the Volume 5, Water Resources and Flood Risk Assessment Map Book.

1.2 Study area

1.2.1 The Primrose Hill to Kilburn (Camden) CFA (CFA3) covers a 3.6km section of the Euston Tunnel (twin-bore tunnel) and a 2.7km section of the HS1-HS2 Link tunnel (a single-bore tunnel). The route of these tunnels passes to the west of Camden Town, to the north of Primrose Hill and south of Swiss Cottage. The route through this area will be entirely in tunnels with two associated ventilation and intervention shafts (vent shafts).

1.2.2 The spatial scope of the assessment was based upon the identification of surface water and groundwater features within 1km of the centre line of the route, except where there is clearly no hydraulic connectivity. For surface water features in urban areas, the extent was reduced to 500m. Outside of these distances it is unlikely that direct impacts upon the water environment will be attributable to the Proposed Scheme. Where works extend more than 200m from the centre line, for example at stations and depots, professional judgement has been used in selecting the appropriate limit to the extension in spatial scope required. For the purposes of this assessment this spatial scope is defined as the study area.

1.2.3 The main environmental features of relevance to water resources within the study area include:

- the Grand Union Canal (Regent's Canal);
- a private licensed groundwater abstraction in South Hampstead (GW67 in Map WR-02-003 (Volume 5, Water Resources and Flood Risk Assessment Map Book)); and
- one groundwater abstraction for public water supply and its associated source protection zone (SPZ) near Primrose Hill.

1.2.4 A key environmental issue relating to water resources is the potential for loss of or damage to the private licensed abstraction in South Hampstead.

1.2.5 Where there is a residual impact to water resources and following mitigation there is a consequent effect on ecology, this is discussed further in Volume 2, Primrose Hill to Kilburn, (CFA report 3), Section 7.

2 Stakeholder engagement

2.1.1 Consultation with the following stakeholders has been undertaken to inform the water resources assessment:

- the Environment Agency;
- Thames Water Utilities Limited;
- London Borough of Camden;
- private licensees by way of a questionnaire and requesting further information or a meeting to more accurately assess and understand any potential risks to private abstractions; and
- the Canal & River Trust (formerly British Waterways) with regard to the Grand Union Canal.

3 Baseline data

3.1 General

3.1.1 The following section provides a current description of water resources within the study area including surface water and groundwater features.

3.1.2 All water bodies in this area fall within the London sub-catchment of the Thames River Basin District as defined under the Water Framework Directive[1] (WFD) and are covered by the River Basin Management Plan[2] (RBMP).

3.2 Surface water features

3.2.1 All surface water features within 500m of the route[3] are presented in Table 1.

3.2.2 The current surface water baseline is shown on Map WR-01-003 (Volume 5, Water Resources and Flood Risk Assessment Map Book). Water features with codes listed in Table 1 are shown on Map WR-01-003 (Volume 5, Water Resources and Flood Risk Assessment Map Book). The map reference is in one of two forms. If the feature has a specific reference number then this is provided (e.g. a surface water crossing will be referenced as SWC-CFA03-01). If the feature has no specific reference its location on a specific map is provided (e.g. WR-01-003, D6) where D6 is a grid reference using the map specific grid.

3.2.3 The surface water features are based on the Environment Agency's Detailed River Network (DRN) with the addition of water bodies noted on the Ordnance Survey's (OS) 'OS VectorMapDistrict'.

[1] Water Framework Directive - *Directive 200/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy,* Strasbourg, European Parliament and European Council.
[2] Environment Agency, (2009), *River Basin Management Plan, Thames River Basin District*.
[3] The Environment Agency's Detailed River Network (DRN) shows the route to cross a culverted watercourse (Map WR-01-002). The watercourse has been included in the DRN to ensure connectivity. It is considered that any such watercourse is a part of the sewer network and is not a surface water feature. It has therefore not been included in this assessment.

Table 1: Surface water features within 500m of the route in the study area

Water feature	Location description (Volume 5 Water Resources and Flood Risk Map Book map reference)	Watercourse classification[4]	WFD waterbody and current overall status	WFD status objective (by 2027 as in RBMP)	Receptor value[5]	Q95[6] (m^3/s)	Catchment area at crossing (km^2)	Notes
Grand Union Canal (Regent's Canal)	The route will pass in tunnel under the Grand Union Canal (Regent's Canal) near Fitzroy Bridge on Gloucester Avenue, Primrose Hill. (SWC-CFA03-01)	Artificial	Grand Union Canal (Uxbridge to Hanwell Locks, Slough Arm, Paddington Arm) (GB70610078) Moderate	Good potential	High	Not applicable	Not applicable	A small section of the Grand Union Canal (Regent's Canal) passes through the area and under a number of bridges including the existing railway lines which run parallel to the route at this point.
Three small ornamental landscaped ponds – Primrose Hill	Located close to Fitzroy Road and Regent's Park Road near Primrose Hill, south of the route (CFA03-P01)	Not applicable	Not applicable	Not applicable	Low	Not applicable	Not applicable	South of the route. Not linked to any surface watercourse, as evident from the Ordnance Survey (OS) mapping.
Hampstead Theatre pond	Located close to Hampstead Theatre, South Hampstead, 20m north of the route near Winchester Road (CFA03-P02)	Not applicable	Not applicable	Not applicable	Low	Not applicable	Not applicable	20m north of the route near Winchester Road, South Hampstead.

[4] Water-feature classifications: Section 113 of the *Water Resources Act 1991* defines a main river as "a watercourse that is shown as such on a main river map". Section 72 of the *Land Drainage Act 1991* defines an Ordinary watercourse as "a watercourse that is not part of a main river". Section 221 of the *Water Resources Act 1991* defines a watercourse as including '"all rivers and streams, ditches, drains, cuts, culverts, dikes, sluices, sewers (other than public sewers) and passages through which water flows". Main rivers are larger rivers and streams designated by Defra on the main river map and are regulated by the Environment Agency.
[5] For examples of receptor values see Table 43 in the Scope and Methodology Report (SMR) Addendum, Volume 5: Appendix CT-001-000/2.
[6] Q95 is the flow which is exceeded for 95% of the time (i.e. it is a low flow and the river will only have flows less than this for 5% of the time).

3.2.4 There are no surface water abstractions within 500m of the route in the study area[7]. There is the potential for unlicensed abstractions to exist, as a licence is not required for abstraction volumes below 20m³ per day.

3.2.5 Table 2 summarises surface water discharge consents within 500m of the route.

Table 2: Surface water discharge consents

Reference number	Permit identifier	Distance (and direction) from route (in metres)	Discharge type	Receiving water feature
CFA3WD1	CTMR.0387	13m south-west	Trade discharges - cooling water	Grand Union Canal (Regent's Canal)

3.3 Groundwater

3.3.1 A summary of the geological units present in the study area, along with their hydrogeological characteristics, is presented in the Land quality Section in Volume 2, Primrose Hill to Kilburn (Camden) (CFA Report 3), Section 8.3.

3.3.2 Map WR-02-003 (Volume 5, Water Resources and Flood Risk Assessment Map Book) indicates the spatial distribution of the uppermost superficial and bedrock formations in the area. A schematic cross-section along the line of the route in this area with regard to geological strata, groundwater elevations (where known) and the scheme is presented in Figure 1.

3.3.3 The London Clay Formation underlies the whole of the study area. The London Clay Formation comprises unproductive strata (non-aquifer).

3.3.4 The geological succession beneath the London Clay Formation comprises of the:

- Harwich Formation, a thin sandy deposit (at least locally);
- Lambeth Group (also termed the Upnor, Woolwich and Reading Formations) which comprises mixed sands, clays and pebbles deposits in some locations;
- Thanet Sand Formation, a greenish and brownish grey, silty, fine-grained sand; and
- White Chalk Subgroup, which is a succession of soft white limestones.

3.3.5 Figure 2 presents the groundwater elevation contours in the Chalk aquifer for this study area and adjacent areas using data from January 2012[8]. It should be noted that the Chalk is confined so the apparent water level is a representation of the water level that would be observed if the Chalk was penetrated by a borehole. It is not indicative of groundwater being present in the London Clay Formation. Groundwater flow in the study area is towards the south-east as shown by the groundwater elevation contours in Figure 2.

[7] Surface water abstractions for public supply are not included.
[8] Environment Agency, (2013), *Management of the London Basin Chalk Aquifer Status Report 2013*.

Figure 1: Schematic cross section of geology and route in the study area.

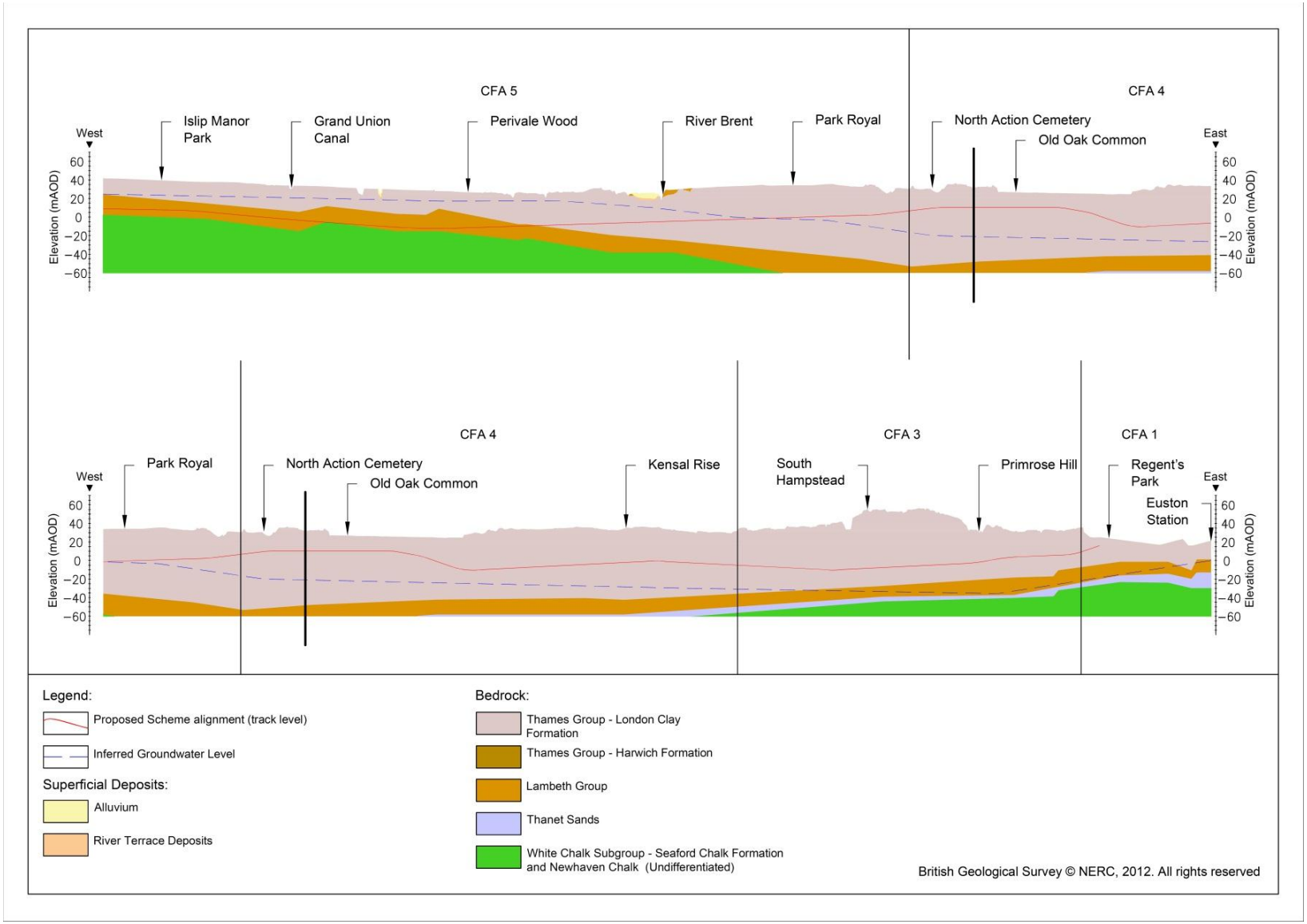
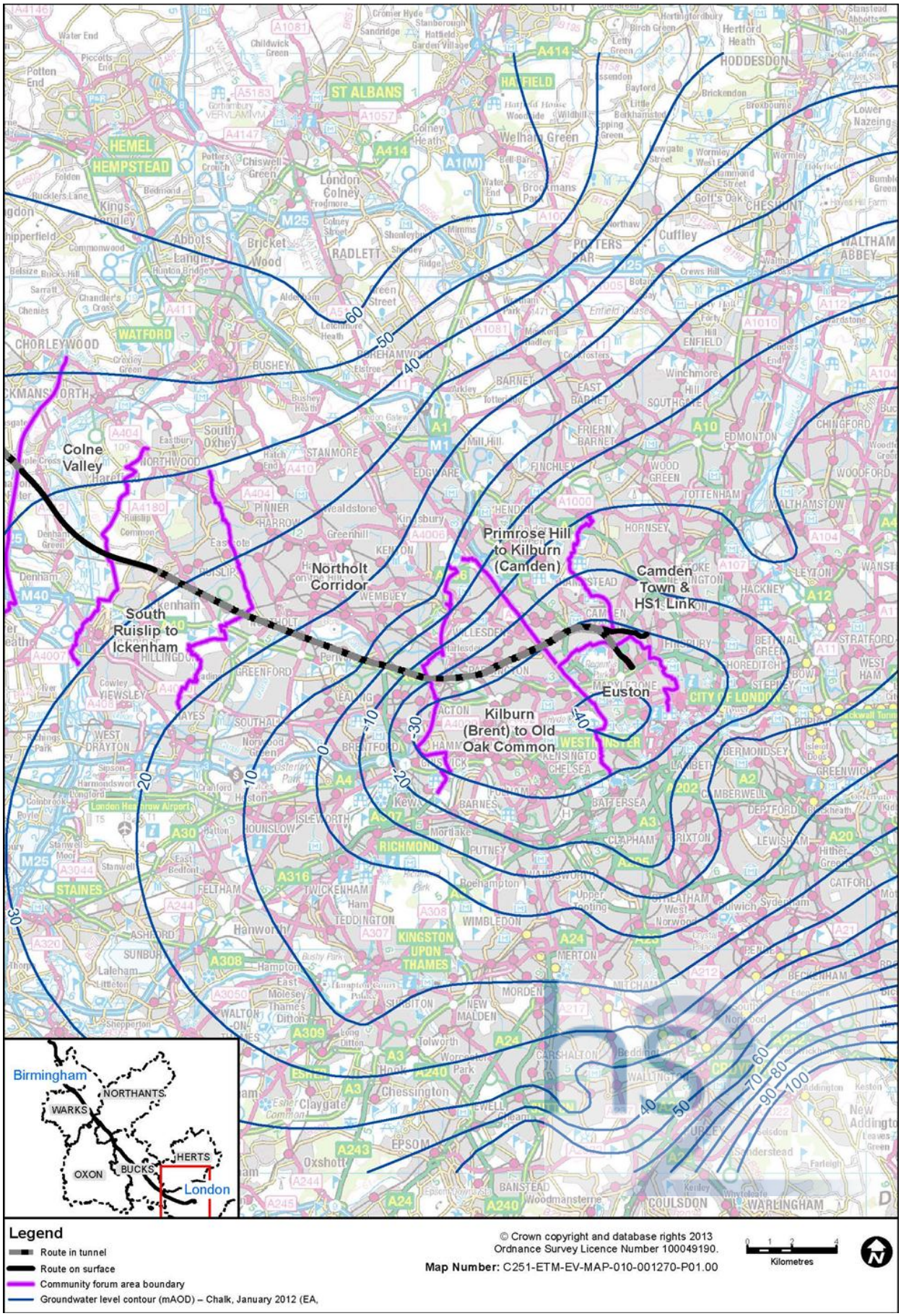


Figure 2: Groundwater elevation contours for this study area and the surrounding area



3.3.6 Table 3 summarises licensed groundwater abstractions and SPZ located within 1km of the route. There is the potential for further unlicensed abstractions to exist, as a licence is not required for abstraction volumes below 20m³ per day.

Table 3: Licensed groundwater abstractions

Licence identifier (map reference number and Environment Agency reference)	Distance and direction from route (m)	Abstraction horizon	Maximum annual abstraction quantity (m^3)	Maximum daily abstraction quantity (m^3/d)	Purpose	Number of boreholes
Public water supplies (PWS)						
SPZ located north of Regent's Park as shown on Map WR-02-003, F7 (Licence identifier confidential)	600m south (SPZ2 will be crossed by the route in this area)	White Chalk Subgroup	631,000	2000	Public water supply	Unknown
Private abstractions						
GW67 28/39/39/0219	Will be within the extent of the Proposed Scheme (assumed as the precise location of this abstraction is not clear)	White Chalk Subgroup	10,512	28.8	Spray irrigation (municipal grounds)	1

3.3.7 There are no consented discharges to ground/groundwater within 1km of the Proposed Scheme in the study area.

3.4 Surface water/groundwater interaction

3.4.1 No surface water/groundwater interactions have been identified within 500m of the route in the study area.

3.5 Water dependent habitats

3.5.1 There are no known water dependant habitats within 1km of the route.

4 Site specific surface water assessments

4.1 Summary of assessment

4.1.1 Table 4 summarises all potential impacts and effects to surface water features associated with the Proposed Scheme in the Primrose Hill to Kilburn (Camden) study area. Only those impacts and effects that are classed as significant are presented in Volume 2, CFA Report 3, Section 13.4.

4.1.2 Table 4 only includes water features which could potentially be impacted by the Proposed Scheme. Features such as isolated ponds and drains which will lie outside the construction footprint and area of impact of the Proposed Scheme are not included. Details of the features, however, are provided in Table 1

4.1.3 The draft Code of Construction Practice (CoCP), referred to in Table 4, sets out the measures and standards of work that will be applied to the construction of the Proposed Scheme (see Volume 5: Appendix CT-003-000/1). These will provide effective management and control of the impacts during the construction period.

Table 4: Summary of potential impacts to surface water.

Surface water feature / receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Grand Union Canal (Regent's Canal)	High	Euston tunnel	Construction works in close proximity to the Grand Union Canal	Negligible impact Neutral effect (Not significant)	None required other than Code of Construction Practice (CoCP) measures	Negligible impact Neutral effect (Not significant)	None	None	Not applicable

5 Site specific groundwater assessment

5.1 Summary of assessment

5.1.1 Table 5 summarises potential impacts upon hydrogeology and abstractions associated with the Proposed Scheme. Only those impacts and effects that are classed as significant are presented in Volume 2, CFA Report 3, Section 13.4.

Table 5: Summary of potential impacts to groundwater receptors.

Receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Hydrogeology (groundwater)									
Chalk Principal aquifer	High	Euston tunnel Adelaide Road vent shaft Alexandra Place vent shaft	No impact is expected as the route will be constructed within the uppermost formation, the London Clay Formation, which is classified as unproductive strata.	Negligible impact Neutral effect (Not significant)	None required	Negligible impact Neutral effect (Not significant)	None	None	Not applicable
Lambeth Group and Thanet Sand Formation Secondary A aquifers	Moderate	Euston tunnel Adelaide Road vent shaft Alexandra Place vent shaft	No impact is expected as the route will be constructed within the uppermost formation, the London Clay Formation, which is a non-aquifer.	Negligible impact Neutral effect (Not significant)	None required	Negligible impact Neutral effect (Not significant)	None	None	Not applicable
Abstractions									
SPZ located north of Regent's Park as shown on Map WR-02-003, F7 (licence identifier confidential)	Very high	Euston tunnel Adelaide Road vent shaft Alexandra Place vent shaft	No impact is expected as the route will be constructed within the uppermost formation, the London Clay Formation, which is a non-aquifer.	Negligible impact Neutral effect (Not significant)	None required	Negligible impact Neutral effect (Not significant)	None	None	Not applicable

Receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Groundwater abstraction license number 28/39/39/0219, reference GW67	Moderate	Euston tunnel	Refer to Section 5.2 for further details.	Major impact Large effect (Significant)	None included in design. Refer to further mitigation column.	Major impact Large effect (Significant)	An alternative water supply will be provided if the abstraction is substantially affected (see Volume 2, CFA Report 10, Section 13).	Negligible impact Neutral effect (Not significant)	Construction (permanent)

5.2 Detailed assessments

Potential impacts on licensed abstraction GW67

5.2.1 The licensed groundwater abstraction located in South Hampstead, west of Winchester Road, is located within the extent of the Proposed Scheme in close proximity to the tunnelling works. Abstraction of up to 28.8 m^3/d is authorised with the use described as spray irrigation.

5.2.2 It is likely that this abstraction will be destroyed by the Proposed Scheme and the ability to use the borehole for spray irrigation purposes will be lost. If this were to happen, it will constitute a major impact on the licensed user's rights of abstraction. As a result, an alternative water supply will be provided, constituting no significant permanent adverse effect.

5.2.3 The loss of this abstraction by the Proposed Scheme will also constitute a loss of asset and as such will be considered by asset protection.

6 References

ARUP/URS, (2012), *HS2 London to West Midlands Environmental Impact Assessment Scope and Methodology Report.*

Arup/URS, (2013), *HS2 London to West Midlands Environmental Impact Assessment Scope and Methodology Report Addendum.*

Environment Agency, (2009), *River Basin Management Plan, Thames River Basin District.*

Environment Agency, (2013), *Management of the London Basin Chalk Aquifer Status Report 2013.*

European Commission, Water Framework Directive - *Directive 200/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, Strasbourg, European Parliament and European Council.*

Land Drainage Act,1991, London, Her Majesty's Stationery Office.

Water Resources Act, 1991, London, Her Majesty's Stationery Office.